Soil Conservation

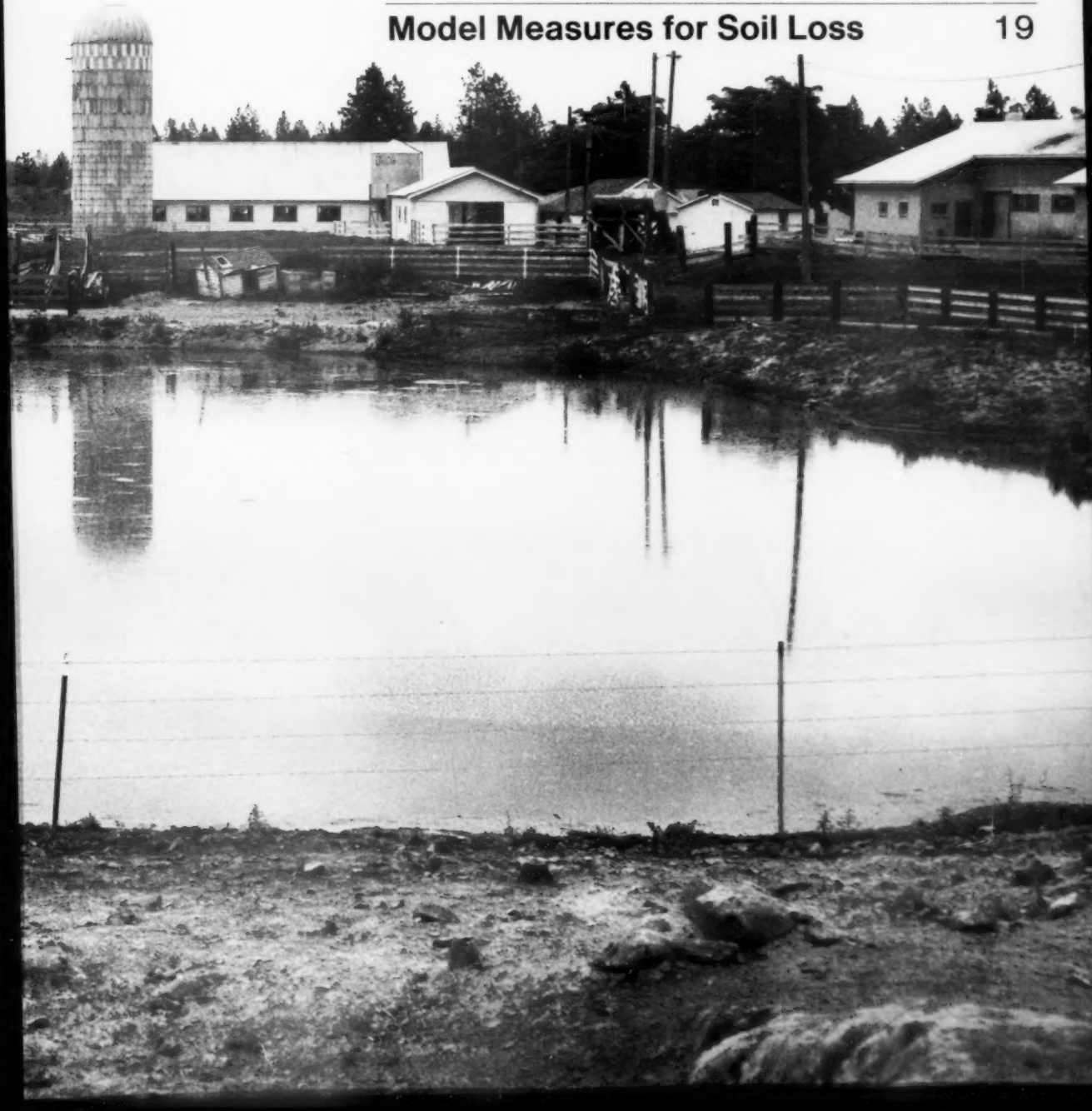
April 1979

U.S. Department of Agriculture

Waste but Not Wasted 10

A Plus for Automation 14

Model Measures for Soil Loss 19



From the Administrator

Waste Management—More Help for Farms and Cities

Few modern conservation problems will be as demanding or as challenging to conservationists in the months and years ahead as the management of organic wastes.

The needs are tremendous. Most of the 800 million dry tons of organic wastes produced annually in the Nation are animal wastes and crop residues. SCS estimates that over 200,000 livestock and poultry operations countrywide need to install modern waste management systems to control air pollution and prevent pollutants from reaching surface waters.

In addition, more cities and communities have begun to recycle municipal wastes. When spread on the land at rates consistent with soil and plant limitations, these wastes are beneficial in controlling erosion, improving the tilth of some soils, and supplying some nutrients. However, when they are applied at excessive rates or when they contain high concentrations of toxic substances, land application can be harmful to the environment. Recycling is not a cure-all for the problem.

The U.S. Department of Agriculture, in a report to Congress last fall on improving soils with organic wastes, cited the value and limits of recycling and the need for more research. SCS has begun a 4-year study jointly with USDA's Science and Education Administration, the U.S. Environmental Protection Agency (EPA), and the Food and Drug Administration to determine background levels of selected heavy metals occurring in various crops and associated soils so that maximum safe levels of these metals can be set. Also, EPA is interested in identifying soils suitable for application of sludge.

Waste management has long been an integral part of the voluntary conservation planning, design, and technical assistance provided by SCS to farmers, ranchers, and communities through conservation districts. By streamlining and refining techniques, we have been able to increase this assistance, and SCS at present helps land users install about 3,500 waste management systems each year.

The safe disposal of organic wastes will continue to rank high on the list of conservation priorities as the States complete plans to control nonpoint pollution of surface waters and when the Rural Clean Water Program (RCWP) becomes operational.

Agricultural waste management would often constitute a "best management practice" eligible for cost sharing when funds become available for long-term RCWP contracts with private land users.

As never before, the Nation will be looking to and depending on conservation districts to seize the challenge and supply the leadership required to cope voluntarily with the complex problems involved in waste management.

Mel Davis

April 1979, Vol. 44, No. 9

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Soil Conservation

Contents

From the Administrator 2

Land Application of Sludge 4
Jamon Baker

Duck Farmers Control Pollution 6
Anthony J. Esser

Composting Sewage Sludge 8

Waste but Not Wasted 10

Conservation Plus Automation Equals Success 14
Frank Jeter, Jr.

Successful Dairy Farm in Puerto Rico 16
Jorge Z. Rivera-Quiñones

Help for a Soggy Tree Farm 18
Frederick E. Bubb

Model Ordinance for Erosion and Sediment Control 19
Robert J. Brejcha

Flax Strips on Fallow Land 22
Del Schapekahm

Meetings 23

Cover:
Anaerobic lagoons are one method for treating animal waste. Other methods are shown in the article beginning on page 10.

Land Application of Sludge

by Jamon Baker

Problems with odors and rising costs of incineration caused Monroe County, N.Y., to look for another way to dispose of its municipal wastes.

Three years ago, residents of Monroe County, N.Y., discovered that incinerating sludge was not a satisfactory method for getting rid of municipal wastes. Homeowners complained bitterly of odors during the summer and taxpayers complained about soaring costs for fuel to run the incinerators.

Through the combined efforts of local officials, and with the help of the Monroe County Soil and Water Conservation District (SWCD), the county began a program to evaluate land application of sludge as a more acceptable alternative to incinerating. Since then, results from tests at the Northwest Quadrant Sewage Treatment Plant have shown that land spreading of sludge may indeed reduce problems of costs and odors for area residents and that sludge can be used to enrich agricultural land.

"The problem started in the 1960's when the plant was built and incineration of sludge seemed the best method," said John Hoff, member of the Monroe County Pure Waters Administrative Board and chairperson of the local SWCD. "Oil to run the incinerators was cheaper then and the plant could be built in a sparsely populated area.

"During the next 10 years, however, Rochester and its suburbs grew rapidly," Hoff continued. "Houses took over what used to be farmland. Fuel became limited and expensive. In fact, during the blizzard of 1976, we couldn't even get the oil to the treatment plant."

The Northwest Quadrant Plant is one of three sewage treatment plants in Monroe County. It serves mostly residential and commercial establishments and processes 11 million gallons of sewage daily. This is the equivalent of 7 tons of dry solids.

Fortunately, when the plant was built, the county purchased additional land to provide for future expansion. Part of this idle land, a 13.5-acre plot, was selected for the initial land spreading pilot program. Since then it has been increased to include approximately 70 acres of county land.

A local committee was appointed by Lucien Morin, Monroe County manager, to study the problems and work on the land application of sludge. The Soil Conservation Service district conservationist was appointed to this committee to assist with the preparation of a complete soil and water conservation plan on the 225 acres of county land adjacent to the treatment plant. The Monroe County Pure Waters District became a cooperator with the Monroe County SWCD.

The conservation plan included stripcropping, grassed waterways, tile drainage, open drainage ditches, and a retention pond. It also included the crops to be grown according to the season of the year with the appropriate planting rates.

Soil samples were collected to be analyzed for heavy metal concentrations. One of the critical problems in spreading industrial wastes on farmland is caused by a buildup in the soil of heavy metals such as zinc, lead, cadmium, and selenium, which are contained in the sludge. Each soil differs in its ability to adsorb concentrations of these heavy metals. If the soil is overloaded, it becomes toxic and the plants or crops grown on the land will suffer or become toxic for humans and animals who consume them. The concentration of heavy metals was recorded at each step of the application process to insure that the soil didn't become overloaded.

The soil was also analyzed to determine levels of phosphorus and nitrogen. Since the land had not been farmed in a

Far left, sludge is trucked from the treatment plant and dumped into the "sludge sled." Near left, the sled was custom made using a tractor, metal container, moldboard plow, tandem disk, and packer.

long time, nutrient levels were low and the soil could accept large amounts of nutrients to bring it up to acceptable levels for crop production. Nutrient levels were also recorded throughout the sludge application process.

SCS designed drainage ditches to carry surface water runoff to a large retention pond built within the plant fenceline. The pond is used to monitor runoff for possible contamination caused by applying the sludge. Six shallow wells were driven around the perimeter of the test plot to monitor the ground water. This monitoring, performed by the Monroe County Division of Pure Waters, can detect the presence of excess nitrates, toxic metals, bacteria, and similar substances.

According to Jon Pitts, manager of the Northwest Quadrant Plant, it took ingenuity to carry out the land spreading operation.

"We tried spreading the sludge with standard equipment but couldn't get any traction under the wheels," said Pitts. "John Ferranti, our assistant supervisor of mechanical operations, thought he could rig up some equipment. And the next day he came in with the design for a 'sludge sled.' "

The "sludge sled," as it is known around the plant, consists of a crawler tractor, metal container with an opening in the bottom, a moldboard plow, tandem disk, and packer.

The sludge is spread and plowed down immediately to prevent odors. Compared with the previous method of incinerating the sludge, there is less odor with land spreading and there have been fewer complaints by area residents.

In fall 1976, after sludge application on the sample plot, plant personnel put in winter wheat. The following spring, after land spreading, neighboring farmers planted buckwheat and corn. As the crops were harvested, they were analyzed to insure their safety according to heavy metal concentrations.

Last summer after studying the results of the sludge application, the Monroe County Health Department approved the use of sludge by farmers in the area. Two cooperators with the Monroe County SWCD requested help from SCS to determine in which fields they could safely apply the sludge and what the safe rate of application would be. After spreading the sludge, they planted winter wheat on 40 acres.

Another farmer has requested help from SCS in planning sludge application after seeing how well it worked on his neighbor's farm.

Assessing the economics of land application of sludge is complex. The fuel costs saved by land application rather than incineration can be estimated. Fertilizer costs the farmers save by using the low-cost sludge instead of commercial fertilizers can also be estimated. In addition, there will be a savings in the energy it takes to produce commercial fertilizers if sludge is used, but the labor requirements for the spreading operation have to be deducted from this savings. One benefit of land application of sludge is difficult to place a dollar value on: the reduction of objectionable odors.

"Overall it appears to be economically cost effective," said Hoff. "The results of the experiment at the Northwest Quadrant Plant may help other communities evaluate the pros and cons of land application of sludge."

Mr. Baker is district conservationist, SCS, Rochester, N.Y.

Sludge is plowed down immediately after spreading to eliminate possible odors. Spreading of sludge is being tried as an alternative to incineration which costs Monroe County as much as $1 million a year for fuel.

District Conservationist Jay Baker (left) and Jon Pitts, manager of the sewage treatment plant, discuss the results of the trial planting of winter wheat on land spread with sludge.

by Anthony J. Esser

Duck Farmers Control Pollution

In response to Federal regulations, Long Island duck farmers are aiming for zero discharge of wastewater and stormwater.

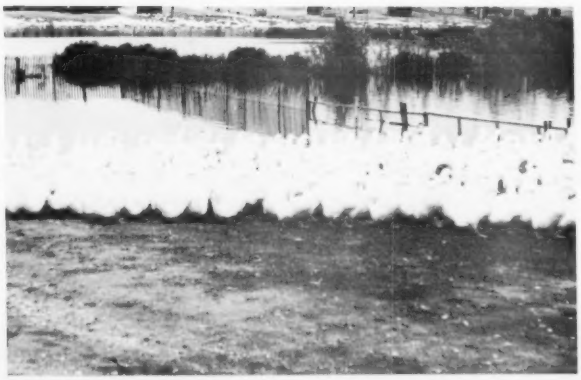
An artificial swimwater was created by building a terrace (right) on sloping land above a natural stream.

At one time, Suffolk County, Long Island, N.Y., was known as the duck capital of the world. However, a rapid increase in land values, high property taxes, and costly pollution control requirements have put many duck farmers out of business. Today on Long Island, only 28 duck farms are still in operation, but they add $80 million a year to Suffolk County's agricultural income.

More than 5½ million ducks are raised each year on Long Island. Waste from these ducks used to be discharged directly into bays and tidal creeks with little or no treatment. But as a result of Public Law 92–500—the Federal Water Pollution Control Act Amendments—and the National Pollutant Discharge Elimination System (NPDES), duck farmers were no longer allowed to discharge untreated waste into these bodies of water.

The New York State and Suffolk County Departments of Environmental Control enforce the NPDES, issuing permits to certify that farmers have met the discharge requirements. The re-

Typically, swimwater from duck pens (near right) is collected in aerated lagoons (far right) where it is agitated. Agitation increases the dissolved oxygen which aids bacterial breakdown of pollutants.



quirements called for farmers, by July 1977, to be able to store stormwater runoff from a 10-year, 24-hour storm event.

Most of the farmers were treating the waste by screening, settling, aeration, and contact chlorination; but they also needed help with diverting clean water around duck pens and feedlots and with plans for storing stormwater.

Farmers turned to the Suffolk County Soil and Water Conservation District (SWCD) for help. USDA's Soil Conservation Service, working through the SWCD, assisted the farmers in developing conservation plans to meet the discharge requirements.

The plans identify the conservation measures needed to divert excess water from feedlot areas, thereby reducing the amount of water needing treatment, and to store feedlot stormwater runoff to prevent untreated or poorly treated wastewater from leaving the farms.

Practices recommended to carry clean water to safe outlets included downspouts and gutters leading to drywells, vertical or French drains, and open ditches and grassed waterways. The plans also provided specifications for duck pen elevations, existing and proposed dike and bulkhead elevations, existing and proposed water elevations, and required and available stormwater storage volumes.

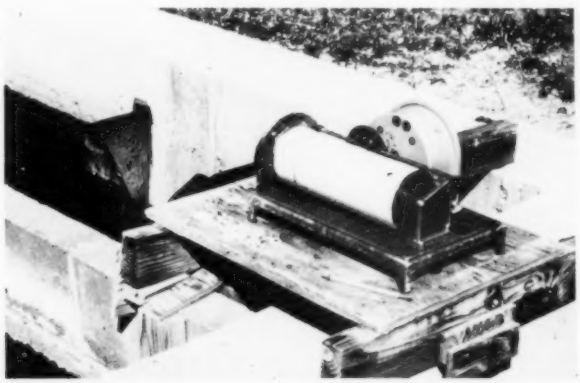
The Suffolk County SWCD was able to provide the duck farmers with an additional service. It made arrangements for the farmers to buy, at a nominal charge, discarded steel dredge pipe from the Suffolk County Department of Public Works. The farmers use the pipe to move swimwater from one location to another, to pipe streams through farms to keep them clean, and to divert clean water around pens, greatly reducing the cost of water management.

By the July 1977 deadline requiring 10-year stormwater storage, all the duck farmers who had requested assistance from the Suffolk County SWCD had either been certified as complying with the requirements or were pending certification while they completed construction. USDA's Agricultural Stabilization and Conservation Service provided financial assistance for installing conservation measures through the Agricultural Conservation Program.

Now that the farmers have met the 1977 requirements, they are looking ahead to 1983. The 1983 regulations require storage of 25-year, 24-hour storm event runoff with 10-day drawdown to normal water. The regulations also contain alternatives for reaching the 1983 requirement of "zero discharge," no discharge of treated duck wastewater or stored stormwater to any surface water body. The alternatives include dryland farming, or raising ducks without swimwater; wastewater recycling; and land application of wastewater using spray irrigation.

The Suffolk County SWCD and SCS are helping the Long Island duck farmers meet the zero discharge requirements by 1983.

Mr. Esser was district conservationist, SCS, Riverhead, N.Y., and is now employed by the New Jersey Department of Agriculture.



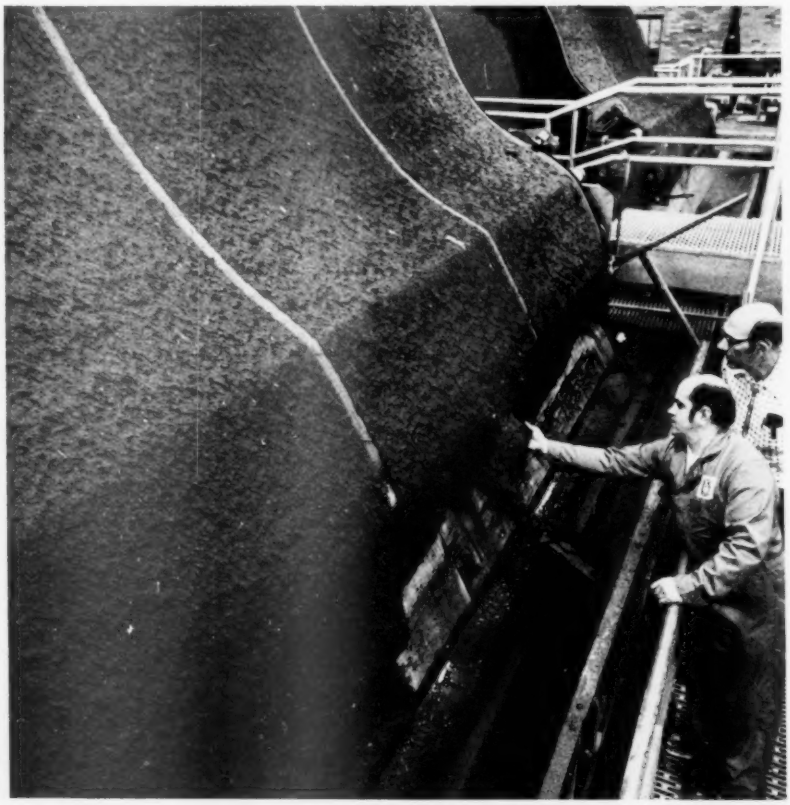
To meet NPDES requirements, duck farmers use discharge flow recorders to measure the amount of discharge from the lagoon systems. The discharge is disinfected in chlorination tanks.

Composting Sewage Sludge

Each day tons of sewage sludge are dumped into rivers, lakes, and the ocean. Environmental and health problems associated with this age-old disposal method require a more effective solution. One of the most promising alternatives is to compost sludge, which is the solid residue left after much of the water is removed from sewage. Composting costs less than incineration and is environmentally sound and esthetic. Compost improves the soil for crops, gardens, and lawns.

Experiments at Beltsville, Md., by USDA's Science and Education Administration, show that composting can be adapted for use on an urban scale. About 50 wet tons of sewage sludge (23 percent solids) is being composted daily on a 15-acre site. An operation of this scale is capable of serving a city of up to 400,000 people. Smaller or larger operations can also be carried out with the same kind of equipment.

An experimental aeration system allows for successful composting even in cold, wet weather without producing obnoxious odors. Temperatures as low as 20° F and rainfall up to 7.5 inches failed to disrupt the Beltsville experiments. Additional tests under more adverse conditions are being made in New England.



Above, sewage sludge mixed with wood chips as a bulking material is composted for use as a soil conditioner, fertilizer, or mulch on a 15-acre test site at USDA's Beltsville Research Center. Scientists are using different chip-to-sludge ratios for composting in windrows or aerated piles. At right, sludge destined for composting rolls off the vacuum filters at the Blue Plains waste water treatment plant near Washington, D.C. George B. Willson of SEA observes as Blue Plains shift supervisor Ed Bobick checks consistency of the sludge. Samples are taken daily and analyzed for acidity, chemical content, and bacteria in compliance with local, State, and Federal laws.

Heat generated during the composting process kills disease-causing organisms. Toxicity to plants from heavy metals was not detected in the compost, although more industrialized communities may have such problems.

Compost's greatest value is as a soil conditioner, increasing the water-holding capacity of the soil and decreasing compactness. It also stabilizes nitrogen in an organic form so that it is released slowly over several years. In many cases, 20 to 25 dry tons of compost per acre can provide all of the nitrogen and most of the phosphorus and essential micronutrients needed for maximum crop yields without polluting ground water with nitrates.

Higher crop yields and better lawns have been produced in experiments with compost. Sod farms and nurseries may also find compost a valuable asset.

This article is taken from Picture Story 294 published by USDA's Science and Education Administration, Agricultural Research.

USDA photos by Robert C. Bjork.

Leaf samples from soybeans and corn fertilized with composted sludge are taken by technicians Timothy W. Palmer and Elizabeth N. Spear. The leaf samples will be analyzed for water, nitrogen, and heavy metals content to help scientists better understand the fertilizer value of composted sludge.

Lush orchardgrass and clover grow on what was once an unsightly sediment-producing strip mine spoil near Frostburg, Md. Composted sludge was applied to the highly acid soil at rates of 25, 50, and 100 tons per acre. Three months after seeding, the spoil was fully vegetated—despite an initial pH of 2.9. Microbiologists George E. Griebel, agronomist Walter H. Armiger, and Maryland strip mine forester Frederick L. Bagley collect forage samples to be analyzed for heavy metals content.

Waste but Not Wasted

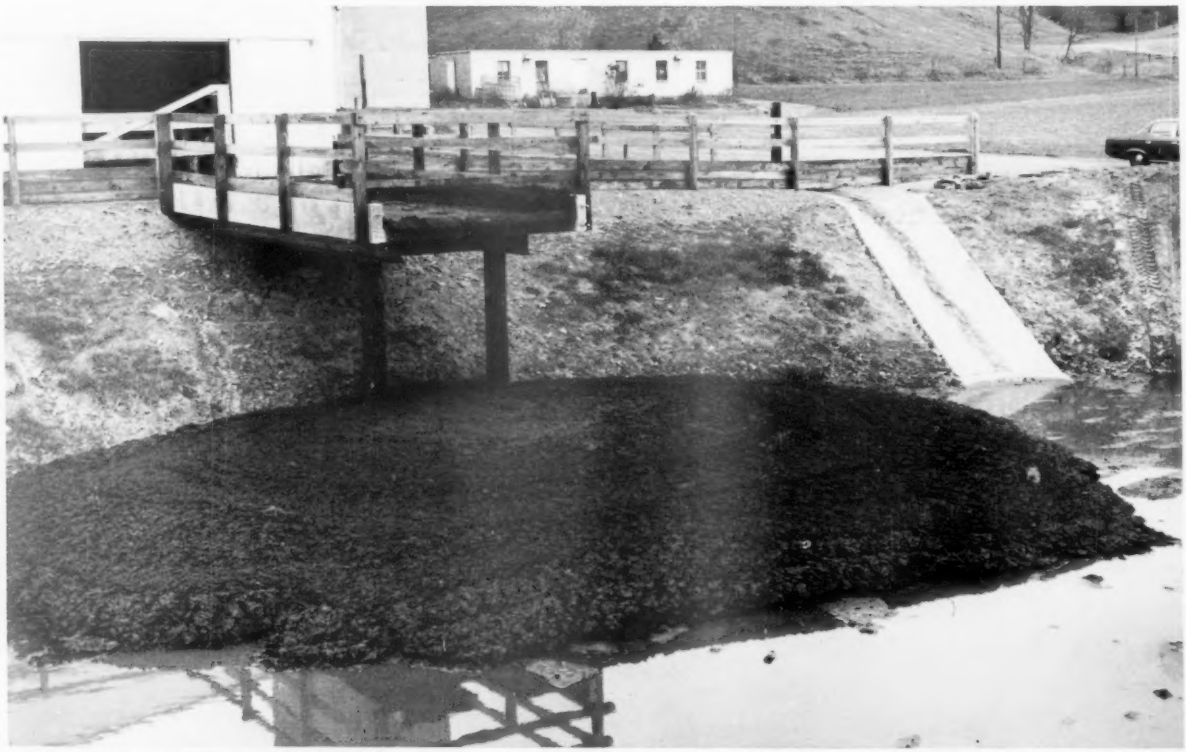
There's a $5 billion resource on farms and ranches around the Nation: animal waste.

Nearly 1.2 billion tons of animal waste (175 million dry tons) is produced annually. The value of the nutrients—nitrogen, phosphorus, and potassium—in the waste comes to $4.7 billion, according to a recent U.S. Department of Agriculture report, *Improving Soils with Organic Wastes*.

Many of these nutrients are already being utilized and, with today's technology, considerable additional saving is feasible.

For example, improved management of manure could save an estimated $170 million in nitrogen, according to the report. This would include providing better storage and handling facilities and improving timely incorporation of manure with soil upon spreading.

In addition, more manure can be applied to the land. The report estimates



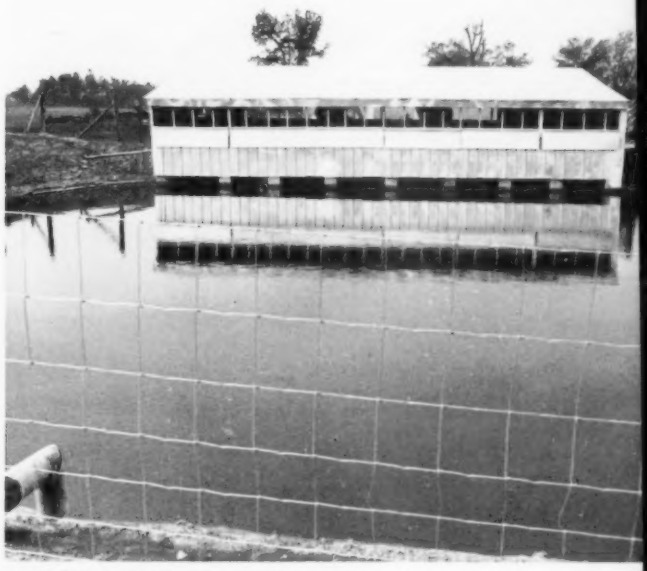
A farmer in Ohio has constructed a pier-type push off for an animal waste holding pond. The pond capacity is 180-day storage for 100 dairy cattle.

that about 7 million more tons of manure from confined areas, such as feedlots, can be utilized on the land. This would bring the national rate of application from confined areas to 84 percent.

On request, through local conservation districts, the Soil Conservation Service provides farmers and ranchers with information on soils, waste disposal systems, and waste disposal system components, such as waste storage ponds, waste treatment lagoons, and waste utilization.

SCS assistance is aimed at preventing or minimizing degradation of air, soil, and water resources and protecting public health and safety. Systems are planned to prevent pollution of surface or ground water and to recycle waste through soil and plants to the fullest extent possible.

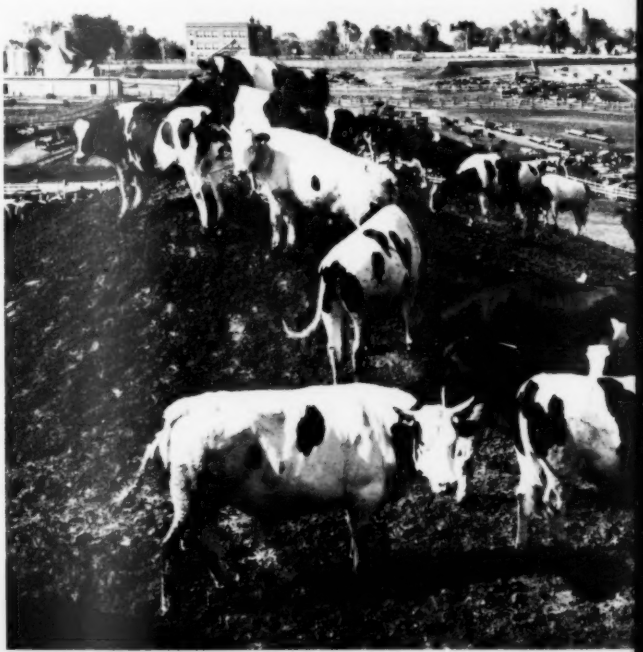
Careful selection of a stacking site for manure can avoid pollution problems.



In Virginia, a hog house overhangs a waste treatment lagoon. Animal waste is mixed with water from a nearby pond and pumped out through the irrigation supply lines to the fields.

Below, raw manure is scraped daily from the corral of this Utah ranch and dropped through the grate into a storage pit. Water is added and the mixture is agitated and pumped into a "honey wagon" for field spreading.

At right, solid and liquid animal wastes are treated in an anaerobic lagoon on a dairy farm in Georgia. The mixture is pumped into carts and hauled to nearby fields and spread.



At right, the "honey wagon" is one of the most common ways to distribute animal waste back onto the land.

At left, animal waste at a large cattle feeding operation in Nebraska is bulldozed into large mounds for drying. The mounds provide a preferred resting place for cattle. Runoff water is collected in a waste storage pond.

Conservation Plus Automation Equals Success

A fast-moving stream of water, recirculated from an anaerobic lagoon, moves poultry waste quickly from one of the Breedlove's three poultry houses.

What do you do with the waste from 50,000 chickens? A lagoon may be the answer.

by Frank Jeter, Jr.

Jerry and Sandra Breedlove have the key to a successful poultry operation: a sound conservation practice—a large waste treatment lagoon—plus automated equipment.

Most poultry operators in eastern North Carolina produce broilers for the frying pan or turkeys for the oven. But the Breedloves of Nash County get young chickens about 8 weeks old and feed them until they're fully grown at 20 weeks.

When the birds "graduate" from the three large, modern poultry houses on the Breedlove's 23-acre farm, they face a future as egg producers and will eventually wind up in canned soup or frozen chicken pot pies.

Before the Breedloves started setting up their poultry operation, they sought technical assistance through the Nash Soil and Water Conservation District from the Soil Conservation Service.

SCS District Conservationist Don Glisson helped the Breedloves design a 3¼-acre anaerobic water treatment lagoon, 6 feet deep. The lagoon is big enough to take care of 56,000 birds, the Breedlove's average poultry population.

Glisson also helped them plan critical area seeding around the lagoon and farm buildings for erosion control.

After the Breedlove's had the lagoon dug, they filled it with water pumped in from a nearby farm pond. They still add pond water occasionally when evaporation lowers the water level. During years when rainfall exceeds evaporation, the Breedloves have arranged to pump lagoon water onto a neighbor's permanent pasture when the ground is dry and will absorb it.

After installing the lagoon, the Breedloves built the three poultry houses and included the newest, most automated equipment for feeding and watering the chickens, who would live in close confinement in wire cages. They put in a flushing system for removal of the tons of manure that would be produced by more than 50,000 chickens.

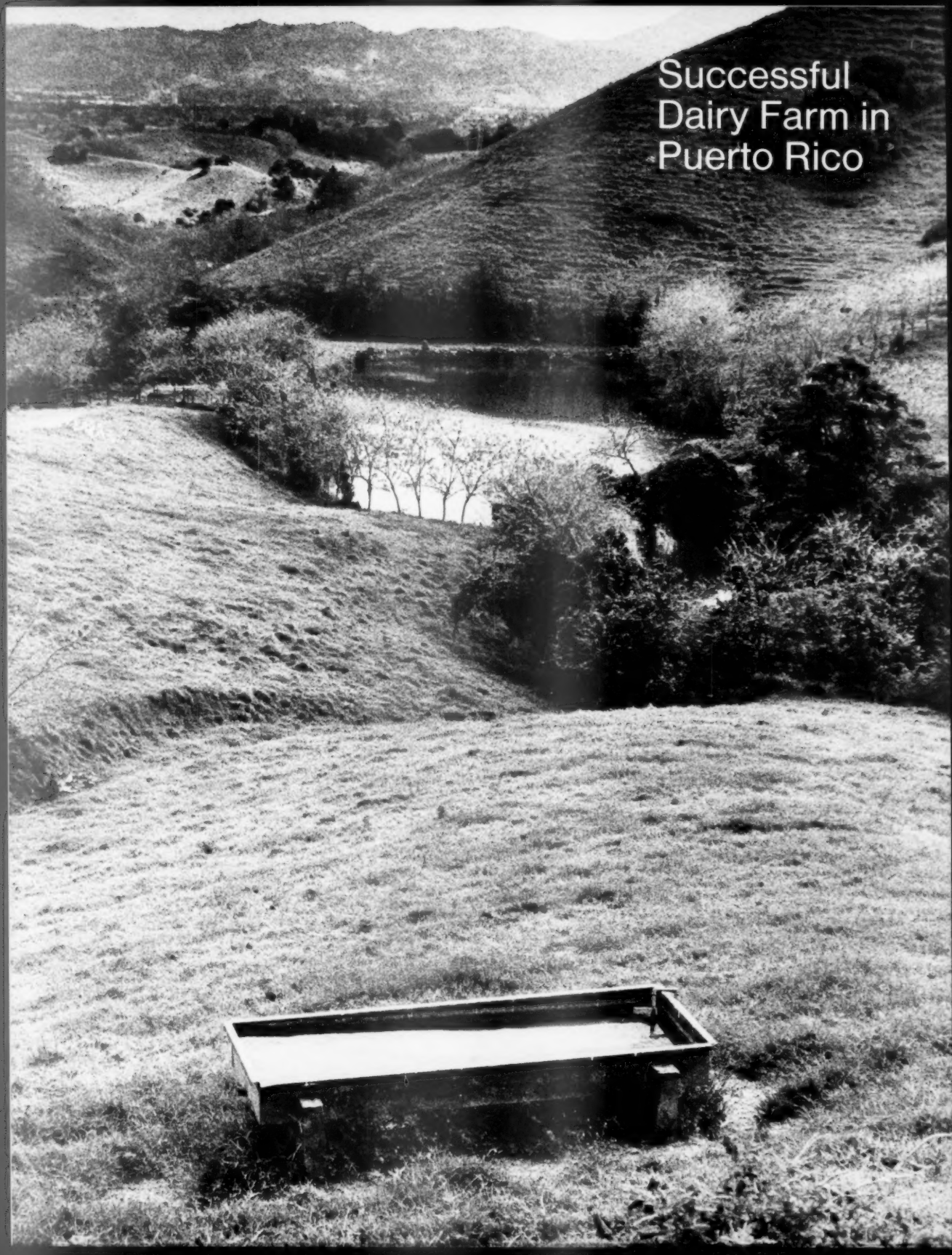
At the turn of a valve, high-pressure water courses through the concrete troughs beneath the wire cages. Gravity flow through piping and a concrete watercourse carry the water and waste to the lagoon. The lagoon provides 15 cubic feet of water per bird, adequate for the need. It will not have to be cleaned out very often because bacterial action breaks down the waste.

The operation is carried out in cooperation with a grain mill which provides birds, feed, and a market for the mature birds.

Since 1974, the machinery, houses, and waste lagoon have all worked smoothly. Jerry and Sandra Breedlove, who have two young sons, consider their money-making poultry business an investment for the future.

Mr. Jeter is public information officer, SCS, Raleigh, N.C.

Jerry Breedlove (left) discusses his waste removal and treatment system with SCS District Conservationist Don Glisson. Glisson helped the Breedloves design a water treatment lagoon which would accommodate the waste produced by more than 50,000 chickens.


Successful
Dairy Farm in
Puerto Rico

Lush grasses now protect once-gullied slopes and provide good grazing for cattle.

by Jorge Z. Rivera-Quiñones

"Hard work and long hours are part of any dairy farm operation," said Myrtha Señeriz, "but you also must use modern conservation methods if you want to stay in the farming business today."

Señeriz is one of the most successful dairy farmers in the hill country of Ward Bairoa-Cagüitas of Aguas Buenas, P.R. She owns and operates a 287-acre, 150-head dairy farm. With her three sons helping, when not in school, and three additional hired helpers, she has increased milk production from 318 to 955 pounds per cow in 3 years.

"Technical conservation planning assistance from the Soil Conservation Service has been a key factor in this improved operation," said Señeriz. "Combining conservation land treatment with properly located structures has benefited me in many ways. I have water for my livestock in each field, erosion control, improved farm roadways, reduced stream pollution from the milking parlor and from sedimentation, improved wildlife habitat and recreation potential, and a more beautiful farm."

Twenty years ago, the Señeriz farm, under another ownership, was planted entirely to sugarcane. As with other hillside sugarcane farms, the steep slopes eroded with the open cultivation. Rich topsoil washed out of the fields to become mud in clogged streams below. Later, under Señeriz's ownership, lush grasses gradually protected the raw gullied fields as they became pastureland for her dairy herd. As a cooperator with the Torito Soil and Water Conservation District (SWCD), she developed a conservation plan with technical assistance from SCS.

Three small ponds, built with SCS engineering assistance, are stocked with bass and bluegill. Other soil and water conservation practices installed on the farm include wells, a spring development, trough and tanks, pipelines, waste treatment lagoon, farm roads and living fences, tree planting, and plantings of stargrass, guineagrass, and pangolagrass.

Señeriz has been a Torito SWCD supervisor since 1971 and the Puerto Rico Association of Soil Conservation Districts recognized her for her distinguished service to conservation districts and for being the best conservationist on the island. She also has won awards from the Chamber of Commerce for her excellent role in agriculture, the Goodyear Tire and Rubber Company for outstanding accomplishments in soil and water conservation, and the Puerto Rico Farmers Association for doing an outstanding job representing Puerto Rican women in the sector of dairy farms.

Myrtha Señeriz hopes to see one of her sons continue her award-winning conservation efforts on the dairy farm.

Mr. Rivera-Quiñones is district conservationist, SCS, Caguas, P.R.

SCS District Conservationist Jorge Rivera-Quiñones discusses dairy farming operations with Myrtha Señeriz. Properly located stock-watering structures and improved pastures are keys to increased milk production.

Help for a Soggy Tree Farm

by Frederick E. Bubb

"To see the land improved was worth more than the money it cost." So stated Woodrow W. Dambach, a cooperator with the Beaver Conservation District and owner of Lake Forest Farms in Fombell, Pa. Dambach made this comment while discussing his recently completed water management project to reduce flood damage.

His 340-acre farm operation includes raising 400,000 Christmas and landscaping trees. The trees grew well on 75 acres of the farm on a highly productive sandy loam soil, which permitted early digging of balled trees in the spring. But the land had one major problem. It flooded often in the late fall and winter months. Low pockets in the fields trapped floodwater and when the water froze, many trees were killed.

"Our loss on that 75 acres went as high as $20,000 in 1 year," Dambach said.

For assistance in solving the problem, he contacted the Soil Conservation Service. Jesse Council, SCS district conservationist, suggested that he install a surface and subsurface water management system.

The water management system consists of 10,800 feet of watercourses which remove floodwater quickly from the field. Culverts and headwalls protect the roadway system which is needed to serve the tree crop. More than 20,000 feet of tile drains carry underground water into the watercourses. The low pockets were filled with spoil from the construction, and the land surface was graded toward the watercourses.

Dambach reported that the project cost him about $10,000. Another $2,500 in cost-share funds was provided through the Agricultural Conservation Program of USDA's Agricultural Stabilization and Conservation Service.

According to Dambach, "We have already increased our useable portion of the 75 acres by 20 percent. On the area we reclaimed, we planted landscaping shrubs and had a 99 percent survival rate where we had trouble growing trees before the project. The project should pay for itself in a few years."

Dambach reported an additional benefit. Because of the increased freedom from flooding, he is now able to convert Christmas tree land to landscaping shrubs, increasing his plant population from 1,900 to 5,400 trees per acre.

"Based on an investment of 50 cents per tree, I am investing a lot more money per acre because I know the project is working," he said. "But my greatest satisfaction is in improving a piece of land. I know that the land will then be available for another generation to use."

Mr. Bubb is public information officer, SCS, Harrisburg, Pa.

SCS District Conservationist Jesse Council (far left) assisted Woodrow Dambach with a water management project on his tree farm. Dambach (near left) checks new plantings of evergreens on drained land. The plantings had a 99 percent survival rate on land where trees had not survived before the project.

Model Ordinance for Erosion and Sediment Control

by Robert J. Brejcha

The Universal Soil Loss Equation plays a leading role in solving mid-America's urban water quality problems.

The Kansas City metropolitan area is suffering from sedimentation. Lake Tapawingo in Jackson County, Mo., offers just one example of the severe siltation facing many lake property owners in the area.

Near right, erosion on this steep grade in Leavenworth County, Kans., was caused by storm water runoff from the paved parking area. Far right, no protection from water erosion was provided at this townhouse development in Wyandotte County, Kans.

In 1974, to help solve countless extreme erosion and sedimentation problems in the Kansas City metropolitan area, the Mid-America Association of Conservation Districts (MAACD) set out to produce a model grading and sediment control ordinance suitable for any unit of government in "mid-America," or anywhere in the country, to follow.

MAACD is made up of eight conservation districts—Cass, Clay, Ray, Platte, and Jackson Counties in Missouri and Johnson, Leavenworth, and Wyandotte Counties in Kansas.

MAACD organized an erosion ad hoc committee which included representatives from private industry, construction firms, interest groups, and government agencies to work on the ordinance. Special assistance came from the Mid-America Regional Council (MARC), a voluntary association established to reinforce and strengthen local governments in the Kansas City region. The association is also a voting member in the Kansas City urban 208 Water Quality Council.

"We had several reasons for developing the ordinance," said former MAACD Chairperson Roy Borgmier of Lawson, Mo., who is now chairperson of the Ray Soil and Water Conservation District. "Naturally we wanted to reduce erosion and sediment damage, but preserving land values and establishing reasonable standards and specifications for erosion control practices were also priorities.

"Local governments are charged with helping States meet Section 208 of Public Law 92–500, the Federal Water Pollution Control Act Amendments of 1972," Borgmier said. When the model ordinance was completed, it was incorporated into the draft of the overall 208 plan for the entire Kansas City metropolitan area.

After receiving public comment on and approval of the ordinance, the MARC board submitted it to the governors of Missouri and Kansas for their sanction. The plan will then go to the U.S. Environmental Protection Agency (EPA) for approval. EPA has supported the ordinance and authorized a printing publication grant for the document which is entitled Model Grading and Sediment Control Ordinance.

"Each conservation district in mid-America now has the job of spreading the word," said Leon Lallier, chairperson of the Wyandotte County Conservation District and MAACD representative. "We must get on with the communication business. Informing officials or jurisdictions is one thing—we want to educate the public as well."

The 208 planning process has been a tremendous education tool. The public has listened and units of government and individuals are responding. For example, Kansas City, Mo., is currently rewriting most sections of its land use planning and zoning regulations and the model ordinance is providing the needed wording for the erosion control section.

In Shawnee, Kans., a family who heard of the new model ordinance used it to persuade the Shawnee Planning Commission to stop construction at a critical site until the development plan was revised to include relevant erosion control standards. The commission now routes all development plans to the Johnson County Soil and Water Conservation District for erosion control re-

Left, a roadside ditch in Shawnee, Kans., has been filled with silt from a nearby construction site. Right, a sediment basin in Independence, Mo., does its job by trapping tons of sediment during construction.

view and comment. The other seven mid-America conservation districts also provide this service.

"The best thing about the ordinance is that it is easy to understand," said Gordon Marking, formerly of MARC.

The model ordinance sets a standard for tolerable soil loss, establishes a procedure for estimating sediment yield from any site, and establishes standards and specifications for applying individual conservation practices.

Developers and private engineers insisted that the model ordinance include standards and specifications for mulching and seeding grass, building sediment basins, and other erosion and sediment control practices used in urban areas.

To provide developers with accurate information on the design, installation, and maintenance of erosion control practices giving the most protection for soil and water resources in the Kansas City region, MAACD adapted the Universal Soil Loss Equation (USLE), developed by USDA's Science and Education Administration and Purdue University.

The ordinance document reads, "An average of 5 tons of soil loss per acre per year will be deemed the maximum tolerable level of sediment leaving a site during development." The ordinance uses the USLE in predicting the average annual soil loss that can be expected from a site under certain conditions.

To make the equation, $A = RKLSCP$, better meet the needs of the ordinance, MAACD added a factor *Y*. *Y* is the sediment yield factor. It gives an estimate, in percent, of sheet and rill erosion that will leave an area as sediment. Since sediment is what pollutes the water, ordinance committee members felt such an onsite measurement was needed.

In the equation, *A* is the predicted average annual soil loss in tons per acre per year; *R* is a measure of the erosive forces of rainfall and runoff; *K* is the soil-erodibility factor, for which a constant value of .32 is used in applying the equation to the Kansas City area; *L* is the slope length factor; *S* is the slope-gradient factor; *C* is the plant cover factor, which is the ratio of soil loss from an area with a specific plant or soil cover to that from bare soil; and *P* is the erosion control practice factor.

Because the *R*, *K*, and *P* factors are considered constant in the Kansas City area, the *C* factor is combined with them to simplify computations. Other communities considering using the ordinance will need to "fine tune" the USLE for their locales.

MAACD has distributed more than 100 copies of the ordinance to local key officials and has mailed copies to 73 cities in States all over the country. "Our association wants to share the ordinance with the entire Nation," said Leon Lallier. "We think we really have something."

The Model Grading and Sediment Control Ordinance written for the Kansas City metropolitan area is proving to be an important tool which will produce environmental improvements in urban areas for mid-America and, perhaps, the Nation.

Mr. Brejcha is resource conservationist, SCS, Independence, Mo.

A concrete structure proved to be too narrow to handle the runoff from a paved parking area in Johnson County, Kans.

Flax Strips on Fallow Land

Flax stands up to snow and protects fallow land from wind and water erosion.

by Del Schapekahm

"I wouldn't take $10 an acre for removal of my flax strips," said Milton Stiegelmeier, a farmer in Walworth County, S. Dak. "On fallow land, flax strips for erosion control mean profit in my pocket. My soil is protected and I have increased yields."

About 5 years ago, Stiegelmeier, a cooperator with the Walworth County Conservation District, planted strips of flax on all of his fallowed land that was not seeded to rye. He has found that this practice has many advantages. The most important is the protection from wind erosion as soon as the flax emerges. In addition, the flax strips beautify the landscape and help reduce air pollution from dust.

In his farming operation, Stiegelmeier plants two-thirds of his cropland to rye and spring wheat and fallows about one-third of his land. Last year he seeded approximately 400 acres of his fallow land with flax strips.

According to Stiegelmeier, the only significant cost to protect the bare land is the flax seed. He seeds at the rate of ½ to 1 bushel of flax seed per acre, depending on the moisture. The flax acreage can be as small as 5 percent of the field. Certified seed is a must, Stiegelmeier cautions, to insure weed-free seed and good germination. Based on the entire field acreage protected, the seed costs from 30 to 50 cents per acre.

When seeding the flax, Stiegelmeier prefers a pony press drill over broadcasting. The pony press gets the seed into the moisture, firms up the seedbed, and results in better stands.

Planting is done simultaneously with tillage of the fallow—usually late July or early August. This way it is not an extra operation and requires very little time. Some strips are planted 12 feet apart with two rows of flax at 6-inch spacing. Others are 37 feet apart with three rows of flax at 6-inch spacing. Spacing is determined by the kind of tillage equipment being used. With normal moisture, the flax is up in 4 to 5 days.

Stiegelmeier prefers having flax strips on the approximate contour where land is rolling. With tillage and strips on the contour, water erosion is reduced during spring runoff. Wind erosion is reduced as well.

The flax straw reaches full maturity with the fall seeding and usually grows about 28 inches tall. It has a stiff straw and stands up well during the winter, holding snow on the field.

"I don't worry about volunteer flax," Stiegelmeier said, "because the seed is killed during freezing weather."

To till the flax strip, Stiegelmeier removes three shovels in the center of his implement and straddles the strip. This tills close to the flax and controls the weeds. Two or three tillage operations after seeding is common in the area.

Last fall, Stiegelmeier fertilized the flax strips at the rate of 30 pounds of nitrogen per acre. This helped replace the nutrients used by the growing flax and offset the nitrogen immobilized by

Flax strips supplement other conservation measures to reduce wind and water erosion on the Stiegelmeier farm.

soil organisms in the decaying process. Fertilizing was done during the last tillage operation.

"Flax strips alone are not the answer to complete erosion control," Stiegelmeier explained, "but they supplement other conservation measures such as conservation tillage.

"One to two tillage operations can probably be eliminated in the spring when flax strips are used because the land has been protected by snow cover and soil clods have been maintained. This will save fuel and equipment—perhaps $2 an acre depending on the size of the implement."

The benefits far exceed the costs and disadvantages of the practice, according to Stiegelmeier, and he encourages other farmers to use flax strips. Their primary purpose is erosion control, but they also allow cross-tillage of fields since the flax strips are temporary; do not interfere with weed spraying; provide snow fences to hold snow; reduce ground freezing through early snow accumulations which allows better moisture intake; distribute snow evenly over fields; and keep snow clean for uniform, slow thawing. Spring crops will benefit from the moisture saved.

Wildlife benefits, too. The straw provides habitat and food for rabbits.

"Flax strips protecting fallowed cropland can be compared to a windbreak protecting livestock," Stiegelmeier concluded. "There is a feeling of contentment and security knowing you have provided protection."

Mr. Schapekahm is district conservationist, SCS, Selby, S. Dak.

Meetings:

April	
1–6	American Concrete Pipe Association, San Antonio, Tex.
4–6	Engineering Geology and Soils Engineering Symposium, Moscow, Idaho
22–25	Association of American Geographers, Philadelphia, Pa.
May	
1–3	International Association for Great Lakes Research Conference, Rochester, N.Y.
6–11	National Council of State Garden Clubs, Inc., New Orleans, La.
23–25	Southern Forestry Conference, Memphis, Tenn.
28–June 1	American Geophysical Union, Washington, D.C.
June	
3–7	American Institute of Architects, Kansas City, Mo.
4–8	General Federation of Women's Clubs, New Orleans, La.
5–7	The Garden Club of America, Milwaukee, Wis.
17–21	Outdoor Writers Association of America, Albuquerque, N. Mex.
24–28	American Seed Trade Association, Inc., Washington, D.C.
24–29	Air Pollution Control Association, Cincinnati, Ohio
24–29	American Water Works Association Conference, San Francisco, Calif.
29–July 1	National Audubon Society Convention, Estes Park, Colo.

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